IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

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DLA PIPER US LLP

By: /Alan A. Limbach/
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APPEAL BRIEF

Sir:

This is a brief for an appeal from a Final Office Action dated April 30, 2008, and from a Notice of Appeal mailed on June 26, 2008.

1. Real Party in Interest

The real party of interest is IRIS Remote Imaging Systems, Inc. of Chatsworth, CA, pursuant to the assignment executed on March 9, 2004, recorded on March 22, 2004 at reel/frame 015111/0615. IRIS Remote Imaging Systems, Inc. has since changed its name to IRIS International, Inc.

2. Related Appeals and Interferences

There are no related appeals or interferences.

3. Status of Claims

Claims 1-38 were originally presented on the filing of the present application. Claim 20 was amended in a response filed August 23, 2007. This is an appeal of the rejected claims 1-38. No other claims are pending or have been cancelled.

4. Status of Amendments

No amendments have been filed subsequent to the Final Office Action of April 30, 2008.

5. Summary of the Claimed Subject Matter

Claim 1

The invention claimed in independent claim 1 is a method for automatically locating a boundary of an object of interest in a field of view (Abstract; Specification, p. 1, lines 25-27). This method involves forming an electronic image of the field of view containing the object, wherein the electronic image is formed of a plurality of image pixels (Specification, p. 5, line 15-p. 6 line 2.).

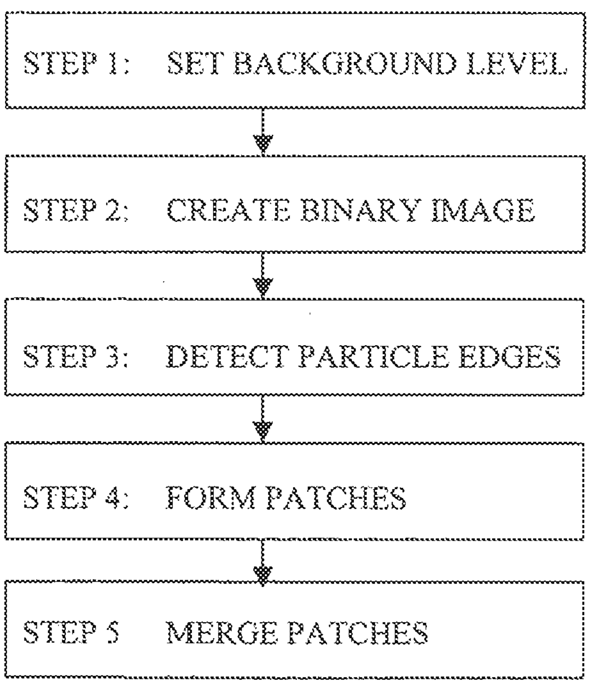

FIG. 2

An example of a binary

electronic image of the field of view containing the object that is formed of a plurality of image pixels is shown in Figure 5.

```
0000000000000000000000000000000000000000
0000000000000000001110000000000000000000
0000000000000000000000000000000000000000
0000000000000000111111000000000000000000
0000000000000011111111111000000000000000
0000000000011111111111111111111000000000
0000001111111111111111111111110000000000
0000001111111111111111111111111111111000
0000111111111111111111111111111111110000
0000000000111111111111111111111111110000
0000111111111111111111111111111101110000
0000001111111111111111111111110010011000
0000000011111111111111111111111110000000
0000000111111111111111111111111111000000
0000000001111111111111111111111110000000
0000000000011111111111111111001000000000
0000000000000001111111111110000000000000
0000000000000000000010111010000000000000
0000000000000000000000011110000000000000
0000000000000000000000000000000000000000
```

FIG. 5

Groups of the image pixels are identified that represent edge segments of the object (Specification, p. 6, line 21- p. 7, line 7). Figure 6 shows the identified edge segments of the object in Figure 5.

```
0000000000000000000000000000000000000000
0000000000000000001110000000000000000000
0000000000000000000000000000000000000000
0000000000000000111111000000000000000000
0000000000000011100001111000000000000000
0000000000011110000000001111111000000000
0000001111110000000000000000000000000000
0000001000000000000000000000000000011000
0000111000000000000000000000000000010000
0000000000000000000000000000000000010000
0000111000000000000000000000000000010000
0000001110000000000000000000000010011000
0000000010000000000000000000001110000000
0000000111000000000000000000000011000000
0000000001111000000000000000001110000000
0000000000011110000000000000000001100000
0000000000000001111111100010000000000000
0000000000000000000010110010000000000000
0000000000000000000000011110000000000000
0000000000000000000000000000000000000000
```

FIG. 6

Patches are formed around the edge segments (in image pixel groups), where each patch is dimensioned and positioned to entirely contain one of the edge segments (Specification, p. 7, lines 10-25). Figure 7 shows the patches P1, P2, P3 and P4 formed around the edge segments of Figure 6.

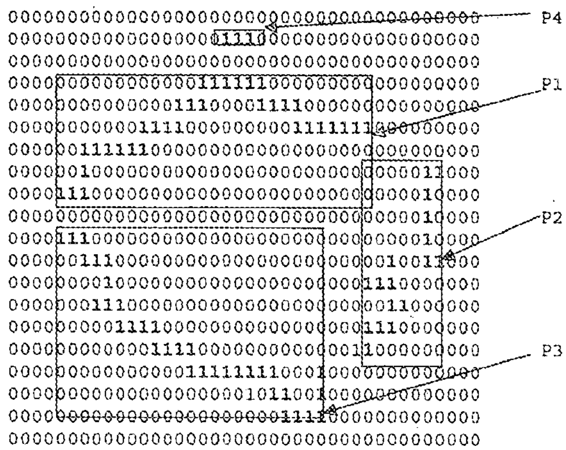

FIG. 7

A patch merge process is then performed that merges any two of the patches together that meet a predetermined proximity threshold relative to each other to form a merged patch that is dimensioned and positioned to entirely contain the two merged patches (Specification, p. 7, line 28- p. 8, line 4). Figure 8A shows an image where the patches of Figure 7 have undergone a first patch merge process, such that patches P1 and P2 have been merged into patch P5.

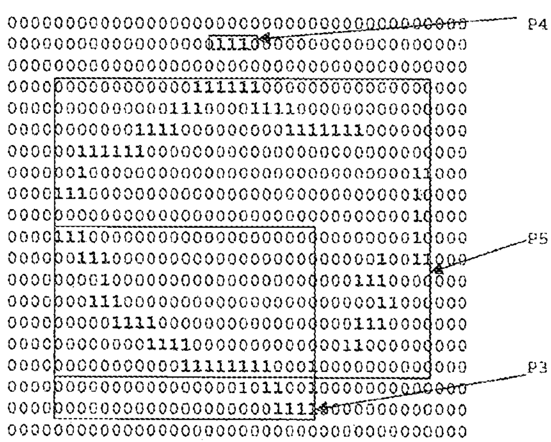

FIG. 8A

The merge process continues iteratively for any of the patches and the merged patches meeting the predetermined proximity threshold until none of the remaining patches and merged patches meet the predetermined proximity threshold (Specification, p. 8, lines 4-6). Figures 8B and 8C show this continuing merge process, where patches P5 and P3 of Figure 8A are merged into patch P6 in Figure 8B, and patches P4 and P6 from Figure 8B are merged into patch P7 in Figure 8C, at which point there are no patches or merged patches left that meet the proximity threshold.

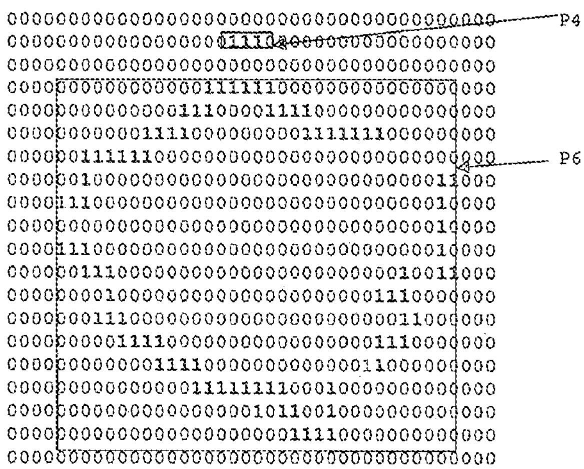

FIG. 8B

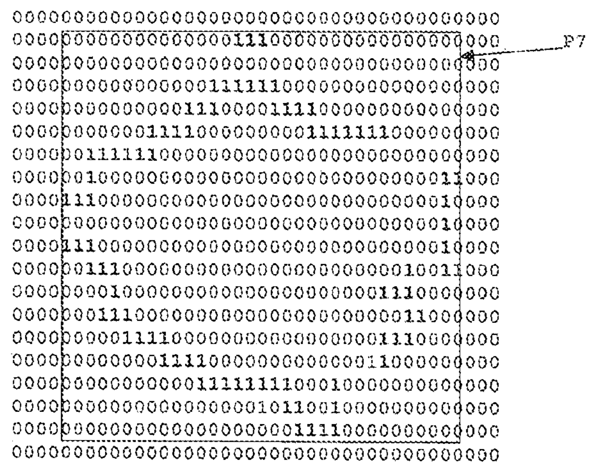

FIG. 8C

Once patch merging is complete, those edge segments found within one of the final patches are associated with a single particle (as representing the boundary of that single particle), and any edge segment(s) found outside of that final patch are associated as either non-particles or part of an adjacent but distinct particle (specification, p. 8, lines 20-23).

Claim 20

Claim 20 is directed to an apparatus for automatically locating a boundary of an object of interest in a field of view (Specification, p. 2, lines 6-16).

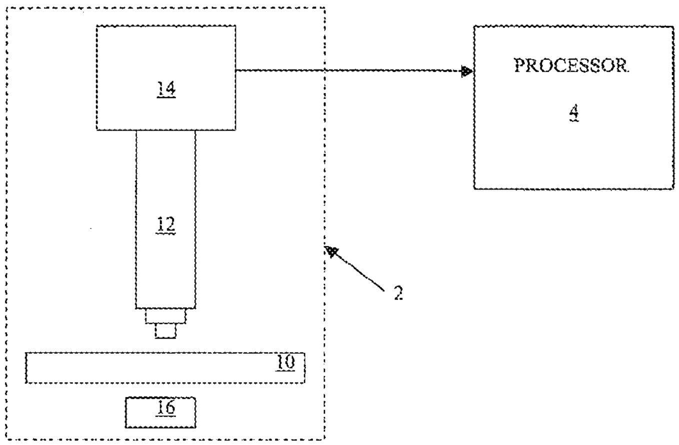

FIG. 1

This apparatus includes an imaging system, shown as block 2 in Figure 1, for forming an electrical image of the field of view containing the object (Specification, p. 3, lines 11-12), wherein the electronic image is formed of a plurality of image pixels (Specification, p. 3, lines 20-21).

The apparatus also includes at least one processor (Specification, p. 3, lines 25-30), shown as block 4 in Figure 1. The processor serves several purposes. The processor is for identifying groups of the image pixels that represent edge segments of the object (Specification, p. 6, line 21- p. 7, line 7; Fig. 6), and forming patches around the edge segments (in image pixel groups) where each patch is dimensioned and positioned to entirely contain one of the edge segments (Specification, p. 7, lines 10-25; Fig. 7).

The processor is also for performing a patch merge process (Specification, p. 3, lines 26-27). The patch merge process merges any two of the patches together that meet a predetermined proximity threshold relative to each other. The resulting merged patch is dimensioned and positioned to entirely contain the two patches being merged (Specification, p. 7, line 28- p. 8, line 4; Fig. 8A). The merge process then continues for any of the patches and merged patches meeting the predetermined proximity threshold until none of the patches and the merged patches meet the predetermined proximity threshold (Specification, p. 8, lines 4-6; Figs. 8B-8C). Once patch merging is complete, those edge segments found within one of the final patches are associated with a single particle (Specification, p. 8, lines 20-23).

6. Grounds Of Rejection To Be Reviewed On Appeal

The sole issue on appeal is whether claims 1-38 are unpatentable under 35 U.S.C. §103 over U.S. Patent No. 4,538,299 (hereinafter "DeForest") in view of pages 1-17 from the IDS of May 28-31, 2002, Vol. 2350/2002 (hereinafter "Schaffalitzky").

7. Argument

Claims 1-38 stand rejected under 35 U.S.C. 103(a) as being unpatentable over DeForest in view Schaffalitzky. The Applicant respectfully traverses this rejection.

Prior art DeForest

DeForest discloses an apparatus and method for automatically locating the boundary of an object in a field of view with a raster scan device in order to generate an electrical image of a field of view (See Abstract; Col. 1, lines 55-56). The image is segmented into pixels with digitized image intensity. Derivative representations are then formed of the image by modifying the value for each pixel with the values of the nearest adjacent neighbors (Col. 1, line 58- Col. 2 line 3). The various possible values for a pixel modified by the nearest adjacent neighbors are stored in a table, where the table receives a pixel value and an input direction, and outputs a direction value to indicate a next location of a pixel with a non zero value. It is the non-zero value pixels that form the object boundary (Col. 2, lines 4-9).

Prior art Schaffalitzky

Schaffalitzky discloses a method for dividing an unordered set of images into clusters of related images. Related images are considered images of the same scene taken from different viewpoints and with different lighting. For related images, the viewpoint of each is determined and the images are organized by spatial relationship (See abstract and Introduction, page 1). A three stage process is disclosed that indexes the images based upon invariant image patches therein, and refining those matches so that images of the same object can be viewed coherently

(see page 2). This allows the establishment of relative view points even when no ordering information is provided, and to enable efficient multiple view matching (see abstract). One method of determining spatial relations is the size of identical objects between different images. A larger image indicates the object is closer, and a smaller image indicates the object is further away (See Fig. 3). The method will typically attempt to find stationary objects of high contrast with respect to the surroundings, such as a dark window, and search for other angles and sizes of the object in other images (See section 2.1 "Covariant regions", pages 4-5 and Fig. 5). The result is to take "an unordered set of images, divide the data into clusters of related (i.e. from the same scene) image and determine the viewpoints of each image, thereby spatially organizing the image set" (see page 1).

The Examiner Has Not Established Prima Facie Obviousness

To establish prima facie obviousness of a claimed invention, all the claim limitations must be taught or suggested by the prior art. In re Royka, 490 F.2d 981, 180 USPQ 580 (CCPA 1974); MPEP 2143.03. Further, there must be something in the prior art as a whole to suggest the desirability, and thus the obviousness, of making the combination. Lindemann Maschinenfabrik GmbH v. American Hoist and Derrick Co., 730 F.2d 1452, 1462, 221 U.S.P.Q. 481, 488 (Fed. Cir. 1984).

<u>Claims 1 and 20</u>

Independent claims 1 and 20 recite a system and method for locating a boundary of an object by:

1) forming an image of the object,

2) identify groups of the image pixels that represent edge segments of the object,

3) form patches around the image pixel groups that are each dimensioned and positioned to entirely contain one of the image pixel groups,

4) performing a patch merge process that merges any two of the patches together that meet a predetermined proximity threshold relative to each other to form a merged patch that is dimensioned and positioned to entirely contain the two merged patches, and

5) continuing the merge process for any of the patches and the merged patches meeting the predetermined proximity threshold until none of the patches and the merged patches meet the predetermined proximity threshold.

This technique more reliably groups together edge segments representing the boundary of a single particle, without unnecessarily including edge segments that are either non-particles or should be associated with another particle, thus allowing any gaps between edge segments from a single particle to be filled in to form a single and continuous particle edge (see specification page 8, lines 20-25).

The Examiner acknowledges on pages 2-3 of the Final Office Action that DeForest fails to disclose the patch formation and merge of claims 1 and 20. The Examiner states on p. 3 of the Final Office Action, however, that Schaffalitzky discloses the claimed patch formation and merge of claims 1 and 20 (citing the abstract, pp. 3-4, 6, and Figs. 5-6), and that it would have been obvious to use the Schaffalitzky patch formation/merge in DeForest's automatic location of the object boundary. The Applicant respectfully submits that Schaffalitzky does not disclose the claimed patch formation/merge.

Schaffalitzky discloses a technique for matching together multiple views of the same object "for navigating in a 3-D scene, moving from one image to whichever image is the next most appropriate" (See Abstract). A three stage process is disclosed that indexes the images based upon invariant image patches therein, and refining those matches so that images of the same object can be viewed coherently (see page 2). This allows the establishment of relative view points even when no ordering information is provided, and to enable efficient multiple view matching (see abstract). The result is to take "an unordered set of images, divide the data into clusters of related (i.e. from the same scene) image and determine the viewpoints of each image, thereby spatially organizing the image set" (see page 1).

It is submitted that determining spatial overlap of images, and ordering them for viewing, in no way teaches or suggests forming patches around image pixel groups representing edge segments of an object, and performing a merge process as recited in claims 1 and 20 until none of the patches and merged patches meet a proximity threshold. Both the process and the results differ. The Schaffalitzky process searches for invariant image patches among different images of the same object, which results in an index that sets forth the order in which the separate images are to be viewed (see three stages solution set forth on page 3). In contrast, the claimed device/process creates patches around image edge segments, and searches for and merges proximate patches, which results in a final merged patch that encompasses all the edge segments to be considered as part of a single object. Therefore, since the process and the end results are different, it is respectfully submitted that Schaffalitzky does not teach or suggest the patch formation and merge of claims 1 and 20.

Because neither cited reference teaches or suggests the claimed patch formation and merge, it is respectfully submitted that claims 1 and 20 are not rendered obvious by DeForest in view of Schaffalitzky, and that these rejections should be withdrawn.

With respect to claims 2-19 and 21-38, these claims depend from claims 1 or 20, and are therefore considered allowable for the reasons set forth above. Moreover, because neither DeForest or Schaffalitzky teach or suggest the claimed general patch formation and merge as recited in independent claims 1 or 20, they certainly do not teach or suggest the particular and more specific features of the patch formation and merge as recited in these dependent claims.

Claims 2 and 21

On page 4 of the Final Office Action, the Examiner maintains that claims 2 and 21 are unpatentable over DeForest in view of Schaffalitzky.

Claims 2 and 21 recite the step of, or at least one processor for, associating all the edge segments contained within one of the merged patches as representing the boundary of the object. DeForest discloses no similar recitation. The Examiner bases the rejection of these claims on

page 6 and Figures 5-6 of Schaffalitzky. However, Schaffalitzky merely discloses matching together multiple views of the same object. Schaffalitzky does not disclose merging patches or associating edge segments as representing the boundary of an object.

Thus it is respectfully submitted that claims 2 and 21 are not rendered obvious over DeForest in view of Schaffalitzky.

<u>Claims 3 and 22</u>

On page 4 of the Final Office Action, the Examiner maintains that claims 3 and 22 are unpatentable over DeForest in view of Schaffalitzky.

Claims 3 and 22 recite that the predetermined proximity threshold is a predetermined number of the image pixels shared by any of the patches and merged patches that overlap each other. The Examiner bases the rejection of this claim on pages 1, 4, 6 and Figures 5-6 of Schaffalitzky. However, Schaffalitzky merely discloses matching together multiple views of the same object. This is done by indexing the images based upon invariant image patches therein, and refining those matches so that images of the same object can be viewed coherently. Schaffalitzky does not disclose any proximity threshold, let alone patches and merged patches that overlap each other.

Thus it is respectfully submitted that claims 3 and 22 are not rendered obvious over DeForest in view of Schaffalitzky.

<u>Claims 4-7 and 23-26</u>

On pages 4-5 of the Final Office Action, the Examiner maintains that claims 4-7 and 23-26 are unpatentable over DeForest in view of Schaffalitzky.

Claims 4 and 23 recite that the predetermined distance is measured from boundaries of the patches and merged patches. Claims 5 and 24 recite that the predetermined proximity threshold is a predetermined distance between any of the patches and merged patches. Claims 6 and 25 recite that the predetermined distance is measured from center portions of the patches and

merged patches. Claims 7 and 26 recite that the predetermined proximity threshold is calculated from the sizes and separation distances of the patches and merged patches.

The Examiner bases the rejection of these claims on pages 1, 4, 6 and Figures 5-6 of Schaffalitzky. Similar to claims 3 and 22, however, Schaffalitzky merely discloses matching together multiple views of the same object. This is done by indexing the images based upon invariant image patches therein, and refining those matches so that images of the same object can be viewed coherently. Schaffalitzky does not disclose any proximity threshold, and does not disclose the proximity thresholds of claims 4-7 or 23-26. Schaffalitzky further does not disclose patches and merged patches that overlap each other.

Thus it is respectfully submitted that claims 4-7 and 23-26 are not rendered obvious over DeForest in view of Schaffalitzky.

<u>Claims 8 and 27</u>

On page 5 of the Final Office Action, the Examiner maintains that claims 8 and 27 are unpatentable over DeForest in view of Schaffalitzky.

Claims 8 and 27 recite that the forming of the patches further comprises dimensioning each of the patches as small as possible while still entirely containing one of the image pixel groups.

The Examiner bases the rejection of this claim on pages 4, 6 and Figure 5 of Schaffalitzky. Yet, Schaffalitzky does not contemplate patch merging, let alone dimensioning patches as set forth in claims 8 and 27.

Thus it is respectfully submitted that claims 8 and 27 are not rendered obvious over DeForest in view of Schaffalitzky.

<u>Claims 9 and 28</u>

On page 5 of the Final Office Action, the Examiner maintains that claims 9 and 28 are unpatentable over DeForest in view of Schaffalitzky.

Claims 9 and 28 recite that after the dimensioning of the patches as small as possible, the forming of the patches further comprises expanding each of the patches by moving wall portions of the patch away from a center of the patch by a predetermined distance. The Examiner bases the rejection of this claim on pages 4, 6 and Figure 5 of Schaffalitzky. Schaffalitzky, however, merely discloses indexing the images based upon invariant image patches therein, and refining those matches so that images of the same object can be viewed coherently. Schaffalitzky does not disclose expanding a patch by moving wall portions of the patch away from a center of the patch by a predetermined distance.

Thus it is respectfully submitted that claims 9 and 28 are not rendered obvious over DeForest in view of Schaffalitzky.

Claims 10 and 29

On page 5 of the Final Office Action, the Examiner maintains that claims 10 and 29 are unpatentable over DeForest in view of Schaffalitzky.

Claims 10 and 29 recite that each of the patches has a rectangular shape. The Examiner bases the rejection of this claim on Figure 5 of Schaffalitzky. Yet Figure 5 of Schaffalitzky simply shows an outline of a non-rectangular window, not merging patches having rectangular shapes.

Thus it is respectfully submitted that claims 10 and 29 are not rendered obvious over DeForest in view of Schaffalitzky.

Claims 11 and 30

On pages 5-6 of the Final Office Action, the Examiner maintains that claims 11 and 30 are unpatentable over DeForest in view of Schaffalitzky.

Claims 11 and 30 recite that the groups of image pixels that represent edge segments of the object are identified by forming a background level image of the field of view, wherein the background level image is formed of a plurality of background level pixels each corresponding

in location to one of the image pixels and each having a pixel value. The Examiner states that this is disclosed in Col. 1, lines 55-60 of DeForest. However, this text only discloses forming an electrical image of the field of view where a digitizer sends gray scale values to a comparator, for threshold segmentation of each pixel into a 1 or 0 group by the comparator. No disclosure is made of a background level image of the field of view.

Claims 11 and 30 further recite classifying as an object pixel each of the image pixels having a pixel value that varies by at least a predetermined amount from the pixel value of the corresponding background level pixel, and identifying which of the object pixels correspond to an edge of the object. The Examiner admits this is not disclosed in DeForest, but states it is in Figure 6 and page 6 of Schaffalitzky. This portion of Schaffalitzky, however, merely discloses shifting a signal's mean, taken over an invariant patch, to zero and then normalizing the power to unity. Schaffalitzky does not disclose any background level image, or classifying as an object any pixel having a value that varies by at least a predetermined amount as an object pixel. .

Thus it is respectfully submitted that claims 11 and 30 are not rendered obvious over DeForest in view of Schaffalitzky.

<u>Claims 12 and 31</u>

On page 6 of the Final Office Action, the Examiner maintains that claims 12 and 31 are unpatentable over DeForest in view of Schaffalitzky.

Claims 12 and 31 recite that the system forms the background level image of the field of view by forming N background electronic images of the field of view not containing any objects of interest, wherein each of the background electronic images is formed of a plurality of background pixels each corresponding in location to one of the background level pixels and each having a pixel value (where N is a positive integer), and generating each one of the background level pixels by calculating a median value of the pixel values for the background pixels corresponding to the one background level pixel.

The Examiner states that Col. 1, lines 55-60 of DeForest discloses forming N background images as claimed. Yet, this text only discloses a digitizer and comparator for threshold segmentation. The Examiner also states that page 8 of Schaffalitzky discloses generating each one of the background level pixels by calculating the mean value as claimed. No such mean value calculation is evident on this page of Schaffalitzky.

Thus it is respectfully submitted that claims 12 and 31 are not rendered obvious over DeForest in view of Schaffalitzky.

Claims 13 and 32

On page 7 of the Final Office Action, the Examiner maintains that claims 13 and 32 are unpatentable over DeForest in view of Schaffalitzky.

Claims 13 and 32 recite that the system flows transparent fluid through the field of view to form the N background electronic images of the field of view. The Examiner states this is disclosed in Col. 2, lines 30-47 DeForest. DeForest, however, only discloses the flowing of transparent fluid through the field of view, and does not disclose the formation of the N background electronic images of the field of view as claimed.

Thus it is respectfully submitted that claims 13 and 32 are not rendered obvious over DeForest in view of Schaffalitzky.

Claims 14 and 33

On page 7 of the Final Office Action, the Examiner maintains that claims 14 and 33 are unpatentable over DeForest in view of Schaffalitzky.

Claims 14 and 33 recite forming the background level image of the field of view by standardizing average values of the background pixel values for each of the N background electronic images before the generation of the background level pixels.

The Examiner states that pages 5-6 and Figure 6 of Schaffalitzky disclose the claimed background level formation technique. Schaffalitzky, however, merely discloses using high

contrast areas as invariant neighborhoods to match between images. There is no disclosure in Schaffalitzky of forming a background level image by standardizing average values of background pixel values for N background electronic images before the generation of background level pixels.

Thus it is respectfully submitted that claims 14 and 33 are not rendered obvious over DeForest in view of Schaffalitzky.

Claims 15 and 34

On page 7-8 of the Final Office Action, the Examiner maintains that claims 15 and 34 are unpatentable over DeForest in view of Schaffalitzky.

Claims 15 and 34 recite that the standardizing average values of the background pixel values further comprises:

1) creating a histogram for each one of the N background electronic images, wherein each of the histograms has a peak value that corresponds to an average value of the background pixel values for one of the N background electronic images;

2) selecting a predetermined average pixel value; and

3) adjusting the background pixel values for the N background electronic images so that the histograms thereof all have peak values generally equal to the predetermined average pixel value.

The Examiner states that page 6 and Figure 6 of Schaffalitzky disclose this standard average value determination technique. Schaffalitzky, however, merely discloses using high contrast areas as invariant neighborhoods to match between images. There is no suggestion of using the claimed histograms for N background electronic images as recited in these claims.

Thus it is respectfully submitted that claims 15 and 34 are not rendered obvious over DeForest in view of Schaffalitzky.

Claims 16 and 35

On page 8 of the Final Office Action, the Examiner maintains that claims 16 and 35 are unpatentable over DeForest in view of Schaffalitzky.

Claims 16 and 35 recite that the predetermined average pixel value is selected such that the adjusted background pixel values do not exceed a maximum pixel value thereof.

The Examiner states this is disclosed on pages 4, 6 and 7 of Schaffalitzky. However, no such disclosure could be found on these pages of Schaffalitzky. Thus it is respectfully submitted that claims 16 and 35 are not rendered obvious over DeForest in view of Schaffalitzky.

Claims 18 and 37

On pages 8-9 of the Final Office Action, the Examiner maintains that claims 18 and 37 are unpatentable over DeForest in view of Schaffalitzky.

Claims 18 and 37 recite that the identifying which of the object pixels correspond to an edge of the object includes re-assigning any of the binary pixels assigned with the first value to the second value that are surrounded by others of the binary pixels all originally assigned with the first value.

The Examiner states that page 4 and Figure 3 of Schaffalitzky discloses this claimed pixel value re-assignment technique. However, no such disclosure of re-assigning binary pixels can be found in the cited portion of Schaffalitzky.

Thus it is respectfully submitted that claims 18 and 37 are not rendered obvious over DeForest in view of Schaffalitzky.

Claims 19 and 38

On page 9 of the Final Office Action, the Examiner maintains that claims 19 and 38 are unpatentable over DeForest in view of Schaffalitzky.

Claims 19 and 38 recite that each of image pixels has a value, and the forming of the electronic image of the field of view containing the object further comprises:

1) creating a histogram for the electronic image containing the object, wherein the histogram has a peak value that corresponds to an average value of the image pixel values;

2) selecting a predetermined average pixel value; and

3) adjusting the image pixel values so that the histogram has a peak value generally equal to the predetermined average pixel value.

The Examiner states that pages 4-6 and Figure 6 of Schaffalitzky disclose this electronic image field formation technique. However, no such disclosure of the above technique (including histogram creation, average pixel value selection, and pixel value adjustment is found in the cited portions of Schaffalitzky.

Thus it is respectfully submitted that claims 19 and 38 are not rendered obvious over DeForest in view of Schaffalitzky.

8. Claims Appendix

Attached herewith please find an appendix containing the claims involved in the appeal.

9. Evidence Appendix

Attached herewith please find an appendix indicating that no other evidence was entered by the Examiner or relied upon by the Applicant.

10. Related Proceedings Appendix

Attached herewith please find an appendix indicating that no decisions have been rendered by a court or the Board related to this appeal.

Conclusion

For all of these reasons, Applicant respectfully submits that the rejections based upon 35 U.S.C. 103 are in error and request the Board to affirm the patentability of the claims on appeal.

Respectfully submitted,

DLA PIPER US LLP

Dated: August 18, 2008

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APPENDIX – CLAIMS ON APPEAL

1. (Original) A method for automatically locating a boundary of an object of interest in a field of view, the method comprising:

forming an electronic image of the field of view containing the object, wherein the electronic image is formed of a plurality of image pixels;

identifying groups of the image pixels that represent edge segments of the object;

forming patches around the image pixel groups, wherein each patch is dimensioned and positioned to entirely contain one of the image pixel groups; and

performing a patch merge process that merges any two of the patches together that meet a predetermined proximity threshold relative to each other to form a merged patch that is dimensioned and positioned to entirely contain the two merged patches, wherein the merge process continues for any of the patches and the merged patches meeting the predetermined proximity threshold until none of the patches and the merged patches meet the predetermined proximity threshold.

2. (Original) The method of claim 1, further comprising:

associating all the edge segments contained within one of the merged patches as representing the boundary of the object.

3. (Original) The method of claim 1, wherein the predetermined proximity threshold is a predetermined number of the image pixels shared by any of the patches and merged patches that overlap each other.

4. (Original) The method of claim 1, wherein the predetermined proximity threshold is a predetermined distance between any of the patches and merged patches.

5. (Original) The method of claim 4, wherein the predetermined distance is measured from boundaries of the patches and merged patches.

6. (Original) The method of claim 4, wherein the predetermined distance is measured from center portions of the patches and merged patches.

7. (Original) The method of claim 1, wherein the predetermined proximity threshold is calculated from the sizes and separation distances of the patches and merged patches.

8. (Original) The method of claim 1, wherein the forming of the patches further comprises:

dimensioning each of the patches as small as possible while still entirely containing one of the image pixel groups.

9. (Original) The method of claim 8, wherein after the dimensioning of the patches as small as possible, the forming of the patches further comprises:

expanding each of the patches by moving wall portions of the patch away from a center of the patch by a predetermined distance.

10. (Original) The method of claim 9, wherein each of the patches has a rectangular shape.

11. (Original) The method of claim 1, wherein the identifying of the groups of image pixels that represent edge segments of the object comprises:

forming a background level image of the field of view, wherein the background level image is formed of a plurality of background level pixels each corresponding in location to one of the image pixels and each having a pixel value;

classifying as an object pixel each of the image pixels having a pixel value that varies by at least a predetermined amount from the pixel value of the corresponding background level pixel; and

identifying which of the object pixels correspond to an edge of the object.

12. (Original) The method of claim 11, wherein the forming of the background level image of the field of view further comprises:

forming N background electronic images of the field of view not containing any objects of interest, wherein each of the background electronic images is formed of a plurality of background pixels each corresponding in location to one of the background level pixels and each having a pixel value, and wherein N is a positive integer; and

generating each one of the background level pixels by calculating a median value of the pixel values for the background pixels corresponding to the one background level pixel.

13. (Original) The method of claim 12, wherein the formation of the N background electronic images of the field of view includes flowing transparent fluid through the field of view.

14. (Original) The method of claim 12, wherein the forming of the background level image of the field of view further comprises:

standardizing average values of the background pixel values for each of the N background electronic images before the generation of the background level pixels.

15. (Original) The method of claim 14, wherein the standardizing average values of the background pixel values further comprises:

creating a histogram for each one of the N background electronic images, wherein each of the histograms has a peak value that corresponds to an average value of the background pixel values for one of the N background electronic images;

selecting a predetermined average pixel value; and

adjusting the background pixel values for the N background electronic images so that the histograms thereof all have peak values generally equal to the predetermined average pixel value.

16. (Original) The method of claim 15, wherein the predetermined average pixel value is selected such that the adjusted background pixel values do not exceed a maximum pixel value thereof.

17. (Original) The method of claim 11, wherein the classifying as an object pixel further includes:

creating a binary image of the electronic image of the field of view containing the object, wherein the binary image is formed of a plurality of binary pixels each corresponding in location to one of the image pixels, wherein each of the binary pixels is assigned to a first value if the corresponding image pixel value varies by at least a predetermined amount from the pixel value of the corresponding background level pixel, and is assigned to a second value if the corresponding image pixel value does not vary by at least the predetermined amount from the pixel value of the corresponding background level pixel.

18. (Original) The method of claim 17, wherein the identifying which of the object pixels correspond to an edge of the object includes:

re-assigning any of the binary pixels assigned with the first value to the second value that are surrounded by others of the binary pixels all originally assigned with the first value.

19. (Original) The method of claim 1, wherein each of image pixels has a value, and wherein the forming of the electronic image of the field of view containing the object further comprises:

creating a histogram for the electronic image containing the object, wherein the histogram has a peak value that corresponds to an average value of the image pixel values;

selecting a predetermined average pixel value; and

adjusting the image pixel values so that the histogram has a peak value generally equal to the predetermined average pixel value.

20. (Previously Presented) An apparatus for automatically locating a boundary of an object of interest in a field of view, comprising:

an imaging system for forming an electrical image of the field of view containing the object, wherein the electronic image is formed of a plurality of image pixels;

at least one processor for:

identifying groups of the image pixels that represent edge segments of the object,

forming patches around the image pixel groups, wherein each patch is dimensioned and positioned to entirely contain one of the image pixel groups, and

performing a patch merge process that merges any two of the patches together that meet a predetermined proximity threshold relative to each other to form a merged patch that is dimensioned and positioned to entirely contain the two merged patches, wherein the merge process continues for any of the patches and the merged patches meeting the predetermined proximity threshold until none of the patches and the merged patches meet the predetermined proximity threshold.

21. (Original) The apparatus of claim 20, wherein the at least one processor associates all the edge segments contained within one of the merged patches as representing the boundary of the object.

22. (Original) The apparatus of claim 20, wherein the predetermined proximity threshold is a predetermined number of the image pixels shared by any of the patches and merged patches that overlap each other.

23. (Original) The apparatus of claim 20, wherein the predetermined proximity threshold is a predetermined distance between any of the patches and merged patches.

24. (Original) The apparatus of claim 23, wherein the predetermined distance is measured from boundaries of the patches and merged patches.

25. (Original) The apparatus of claim 24, wherein the predetermined distance is measured from center portions of the patches and merged patches.

26. (Original) The apparatus of claim 20, wherein the predetermined proximity threshold is calculated from the sizes and separation distances of the patches and merged patches.

27. (Original) The apparatus of claim 20, wherein the forming of the patches by the at least one processor further comprises:

dimensioning each of the patches as small as possible while still entirely containing one of the image pixel groups.

28. (Original) The apparatus of claim 27, wherein after the dimensioning of the patches as small as possible, the forming of the patches by the at least one processor further comprises:

expanding each of the patches by moving wall portions of the patch away from a center of the patch by a predetermined distance.

29. (Original) The apparatus of claim 28, wherein each of the patches has a rectangular shape.

30. (Original) The apparatus of claim 20, wherein the groups of image pixels that represent edge segments of the object are identified by the at least one processor by:

forming a background level image of the field of view, wherein the background level image is formed of a plurality of background level pixels each corresponding in location to one of the image pixels and each having a pixel value;

classifying as an object pixel each of the image pixels having a pixel value that varies by at least a predetermined amount from the pixel value of the corresponding background level pixel; and

identifying which of the object pixels correspond to an edge of the object.

31. (Original) The apparatus of claim 30, wherein the system forms the background level image of the field of view by:

forming N background electronic images of the field of view not containing any objects of interest, wherein each of the background electronic images is formed of a plurality of background pixels each corresponding in location to one of the background level pixels and each having a pixel value, and wherein N is a positive integer; and

generating each one of the background level pixels by calculating a median value of the pixel values for the background pixels corresponding to the one background level pixel.

32. (Original) The apparatus of claim 31, wherein the system flows transparent fluid through the field of view to form the N background electronic images of the field of view.

33. (Original) The apparatus of claim 31, wherein the at least one processor forms of the background level image of the field of view by:

standardizing average values of the background pixel values for each of the N background electronic images before the generation of the background level pixels.

34. (Original) The apparatus of claim 33, wherein the at least one processor standardizes the average values of the background pixel values by:

creating a histogram for each one of the N background electronic images, wherein each of the histograms has a peak value that corresponds to an average value of the background pixel values for one of the N background electronic images;

selecting a predetermined average pixel value; and

adjusting the background pixel values for the N background electronic images so that the histograms thereof all have peak values generally equal to the predetermined average pixel value.

35. (Original) The apparatus of claim 34, wherein the at least one processor selects the predetermined average pixel value such that the adjusted background pixel values do not exceed a maximum pixel value thereof.

36. (Original) The apparatus of claim 30, wherein the at least one processor classifies the object pixels by:

creating a binary image of the electronic image of the field of view containing the object, wherein the binary image is formed of a plurality of binary pixels each corresponding in location to one of the image pixels, wherein each of the binary pixels is assigned to a first value if the corresponding image pixel value varies by at least a predetermined amount from the pixel value of the corresponding background level pixel, and is assigned to a second value if the corresponding image pixel value does not vary by at least the predetermined amount from the pixel value of the corresponding background level pixel.

37. (Original) The apparatus of claim 36, wherein the at least one processor identifies which of the object pixels correspond to an edge of the object by:

re-assigning any of the binary pixels assigned with the first value to the second value that are surrounded by others of the binary pixels all originally assigned with the first value.

38. (Original) The apparatus of claim 20, wherein each of image pixels has a value, and wherein the at least one processor forms the electronic image of the field of view containing the object further by:

creating a histogram for the electronic image containing the object, wherein the histogram has a peak value that corresponds to an average value of the image pixel values;

selecting a predetermined average pixel value; and

adjusting the image pixel values so that the histogram has a peak value generally equal to the predetermined average pixel value.

APPENDIX - EVIDENCE

None.

APPENDIX - RELATED PROCEEDINGS

None.